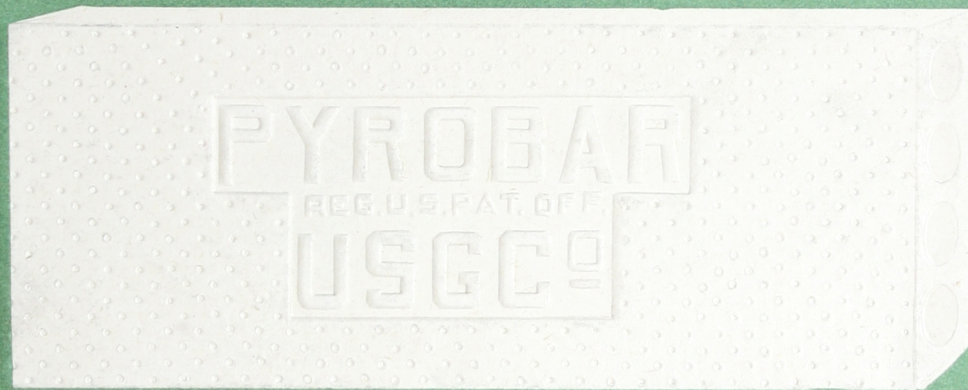


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PYROBAR GYPSUM TILE

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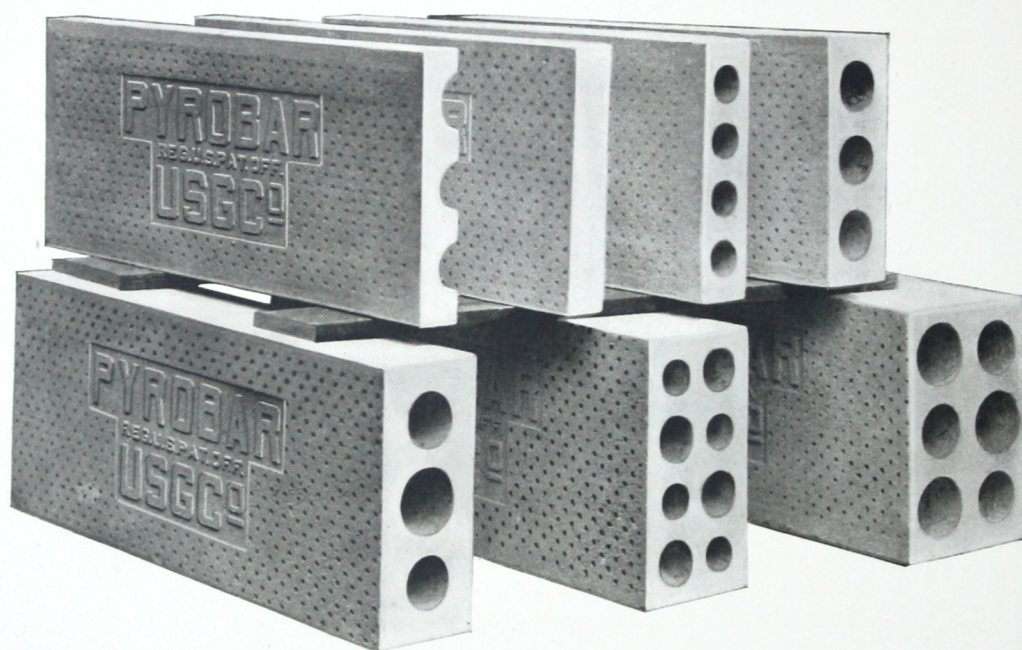
Highest Standard of
Fireproofing Excellence

GYPSUM THE
PYROBAR

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537-18.



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United States Gypsum Company

Pyrobar Gypsum Tile

Approved by National Board
of Fire Underwriters

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Greater Efficiency
Lower    Cost

UNITED STATES GYPSUM COMPANY
CHICAGO

NEW YORK - BUFFALO - CLEVELAND - DETROIT
MINNEAPOLIS - KANSAS CITY - SAN FRANCISCO

GYPSUM

Gypsum is a form of natural rock, white or light gray in color, and is either mined or quarried.

Chemically speaking, gypsum is calcium sulphate in chemical combination with about 21 per cent of water of crystallization.

In the process of manufacture the gypsum rock is crushed, dried and then ground to a fine powder. The powdered gypsum rock is then heated by standard methods and apparatus until the necessary quantity of water of crystallization is driven off in the form of steam.

This liberation of the water of crystallization is termed calcination, and the resultant product is commercially known as calcined gypsum.

When calcined gypsum is mixed with water, the percentage of water that was driven off during manufacture again enters into combination with it, producing a structural material which chemically and physically corresponds with the natural rock.

Calcined gypsum is used in the manufacture of PYROBAR Partition Tile, Furring Tile, Vent Duct Tile, and Column and Beam Protection, which are herein described. Calcined gypsum also forms the basis of numerous other products, including U. S. G. Wall Plasters, Sackett Plaster Board, Structolite (a specially prepared, extra dense gypsum for structural purposes), PYROBAR (Structolite) Roof Tile and PYROBAR (Structolite) Floor Filler Tile.

UNITED STATES



GYPSUM COMPANY

100-12568-101

PYROBAR GYPSUM TILE

The superior quality of PYROBAR Tile as a fireproof building material was definitely established by tests made by the Underwriters' Laboratories, Inc., in 1910 and 1912. As a result, PYROBAR Gypsum Tile are officially approved and the National Board of Fire Underwriters' recommendations regarding the use of PYROBAR are contained in their 1915 Building Code.

*The Standard
Fireproofing*

Gypsum Tile is the only structural building material that has passed the test and received the approval of the Underwriters' Laboratories for fire-proof construction.

PYROBAR Partition Tile consist of 96 per cent gypsum and 4 per cent fibre. They are the only gypsum tile moulded by continuous automatic machine process, which insures accurate proportions and even distribution of gypsum, fibre and water; the result being tile of uniform size, weight, strength and density. A PYROBAR Tile is 30 inches long, one foot high, and the tile are made in various thicknesses from 1½ to 8 inches. For the protection of architects, engineers and contractors, all Pyrobar Gypsum Tile bear this trade-mark "PYROBAR—Reg. U. S. Pat. Off.—U. S. G. Co."

*Distinctive
Quality*

PYROBAR Gypsum Tile are used in buildings of all types and classes for fireproof construction purposes as follows:

*Various
Uses*

1. Non-bearing corridor walls, partitions, wall furring and false columns and pilasters;
2. Fire division walls;
3. Elevator, stairway and dumb-waiter enclosures;
4. Light wells, pipe chases, heat and vent ducts;
5. Column, beam, girder and other steel protection;
6. Partitions and corridor walls in merchandise storage warehouses;
7. Floor fill instead of cinder concrete fill.

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ADVANTAGES

The Ideal Fireproofing Material

PYROBAR owes its superior fire-resistive qualities to its remarkable non-conductivity. Less than 5 per cent of the heat on the fire side of PYROBAR is transmitted through the tile. PYROBAR, therefore, does not expand or contract sufficiently under actual fire conditions to cause the wall to collapse or crack. PYROBAR also affords by far the greatest fire protection for structural steel members, because it prevents the heat from reaching the steel and causing it to fail. See "Why PYROBAR Bars Fire" and Underwriters' Tests, pages 10 to 22.

Non- Conductor of Sound

PYROBAR is 60 per cent more effective than clay tile in preventing sound transmission, as demonstrated by extensive laboratory tests made by the Lewis Institute of Technology, Chicago. See report on page 24.

Non- Conductor of Heat

Scientific tests prove that PYROBAR has 40 per cent more resistance to heat conduction than clay tile. See Armour Institute tests page 23.

Reduces Dead Load

Gypsum Tile are 35 per cent lighter per square foot than any other tile of the same thickness, thereby reducing the dead load to be carried and saving weight of steel in columns and beams. See table of comparative weights, page 25.

Rapid Construction

Because PYROBAR Tile are light and are made in large units (2½ square feet), they are handled and erected very rapidly. The average mechanic will lay 60 per cent more PYROBAR than clay tile in a day and do a neater, more workmanlike job. The Tile are easily sawed and fitted. Chases and ducts may be neatly sawed after partitions are erected.

Uniform Size

PYROBAR Tile are not warped and distorted in manufacture, as they are not burned in kilns, but are cast in steel moulds, hence are uniform in size and have true surfaces. A Gypsum Tile wall, by reason of its even face, requires one-third less plaster than is required by any other fire-proof wall construction.

Low Cost

In every phase of construction there is economy with PYROBAR Tile. Their use means an actual and considerable saving in structural steel, in plastering material, in mortar, and in labor in trucking, hoisting and erecting. Due to the toughness of PYROBAR, breakage in handling

UNITED STATES



GYPSUM COMPANY

is negligible, and, as all pieces of broken tile can be utilized, there is little or no waste. The great speed with which PYROBAR can be erected makes earlier occupancy of the building possible.

As PYROBAR is composed of Gypsum and is laid up with Gypsum mortar, Gypsum plaster unites with it perfectly, the whole forming a homogeneous and permanent structure. The tile are strong, and the large units minimize the number of mortar joints, so that the walls are of extraordinary rigidity. PYROBAR walls offer the greatest possible resistance to fire and sound. Containing nothing but pure calcined gypsum and a small per cent of non-staining fibre, there is no foreign ingredient, acid or alkali, in PYROBAR to stain the plaster or wall decorations; also there will be no unsightly discolorations due to efflorescence.

*The
Perfect
Wall*

Obviously these permanent, fireproof, stainless walls will be the most economical, as there will be no upkeep expense to charge against them. PYROBAR Furring Tile walls greatly reduce fuel consumption in winter. PYROBAR also reduces alteration expense to the lowest possible minimum, owing to its speedy erection and the fact that fitting around window and door openings can be quickly done by sawing.

*Yearly
Economy*

All these advantages emphasize PYROBAR Gypsum Tile as the ideal fireproofing material.

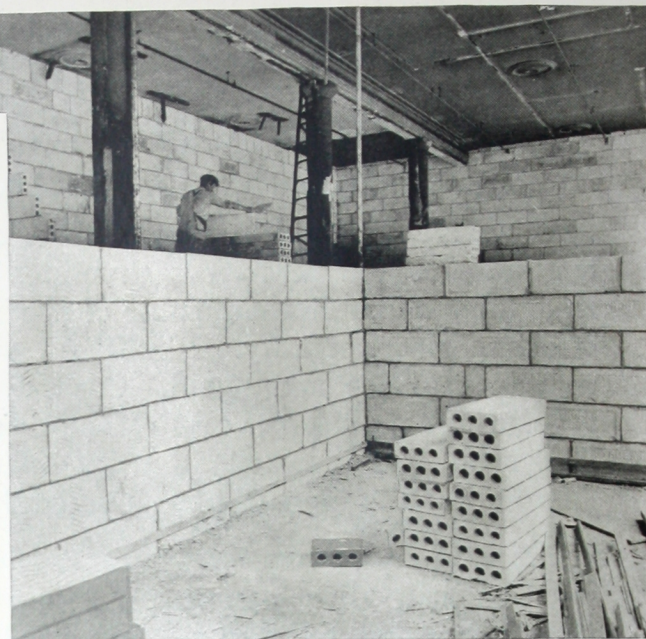
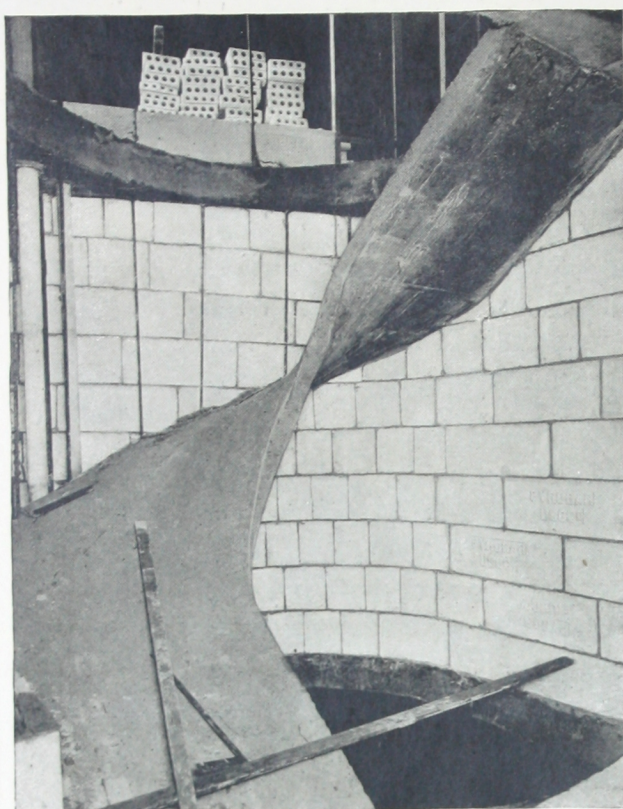


PYROBAR Used for Difficult Wall and Furring Construction.

UNITED STATES



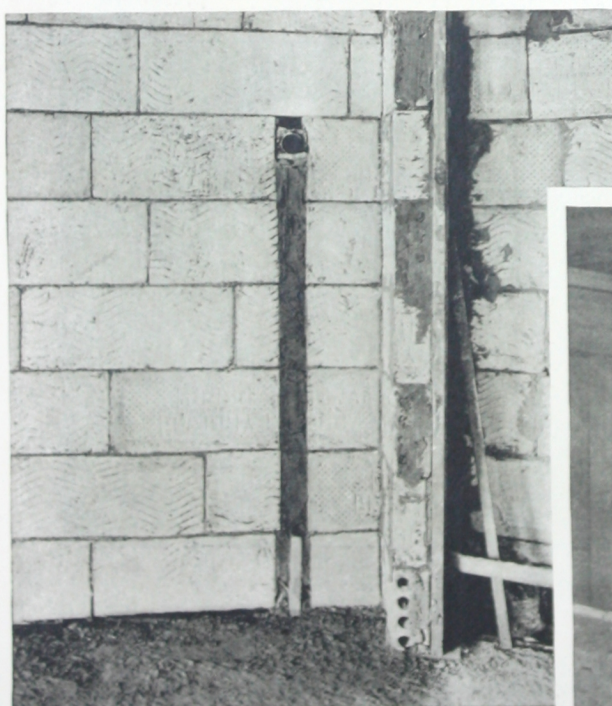
GYPSUM COMPANY

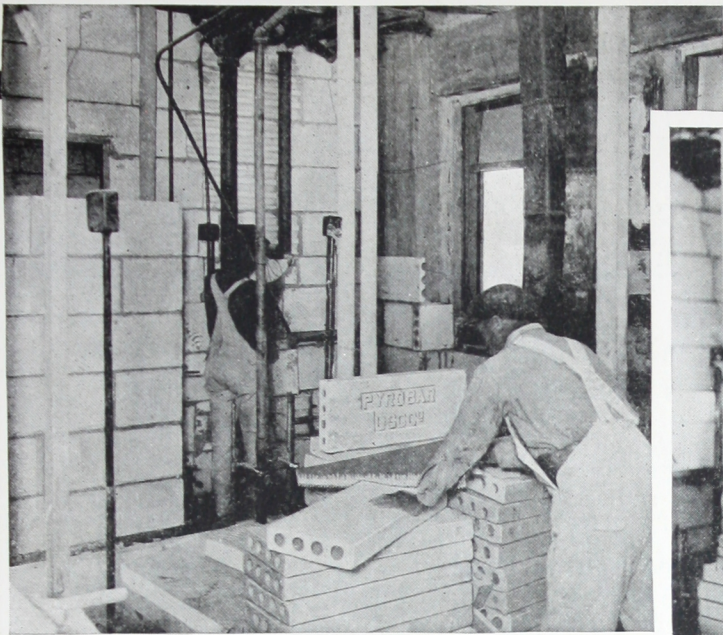


These illustrations show the adaptability of PYROBAR to every condition of building construction.

Views at left: curved and intersecting walls; ease of constructing pipe and conduit chases.

Views immediately above and below show use of PYROBAR without plaster for storage warehouse partitions.

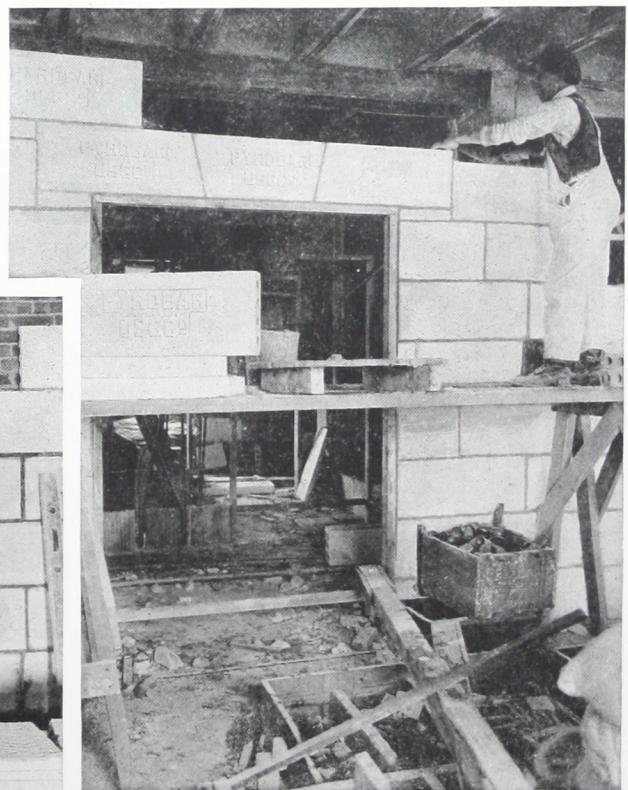




PYROBAR Gypsum Tile can be sawed to fit all requirements of construction. Made in large units, $2\frac{1}{2}$ square feet, straight and true. When bonded together with gypsum mortar, they form a homogeneous mass.

PYROBAR Furring Tile is applied directly to the walls—no waste—no delay.

Note jack-arch construction over doorway.



WHY PYROBAR BARS FIRE

Functions of Fire Resistive Material

The two purposes of a fire resistive material are:

- 1st—To retard the progress of fire by confining it to its point of origin.
- 2nd—To insulate steel members from the destructive effects of high temperatures.

The Essential Factors

The effectiveness with which any fire-resistive material performs each of the foregoing functions depends upon two inherent qualities:

- (A)—Low coefficient of conductivity.
- (B)—Low total amount of expansion and contraction.

Let us consider these essentials in the order named, first in relation to retarding the progress of fire and then in relation to the insulation of steel members.

PYROBAR HAS LOW COEFFICIENT OF CONDUCTIVITY

Temperature Never Exceeds 212° F.

From diagram on next page it will be noted that the temperature of PYROBAR Gypsum Tile, except on the surface exposed to the fire, *cannot exceed 212° F.* This is due to the fact that the water of crystallization in the gypsum must be vaporized as the tile slowly calcine, and this calcined portion—the air cells of which are filled with steam—is a truly remarkable insulator of heat. The calcined gypsum does not flake away, but adheres tenaciously to the tile like a protective armor, *becoming increasingly non-conductive from hour to hour as the calcined portion becomes thicker.* It has been said that “PYROBAR actually fights fire.”

No Ignition Through Partition

Owing to the low heat conductivity of PYROBAR, there is absolute freedom from danger of ignition of combustible material on the side of a PYROBAR partition opposite the fire—a frequent occurrence with a material that readily transmits heat.

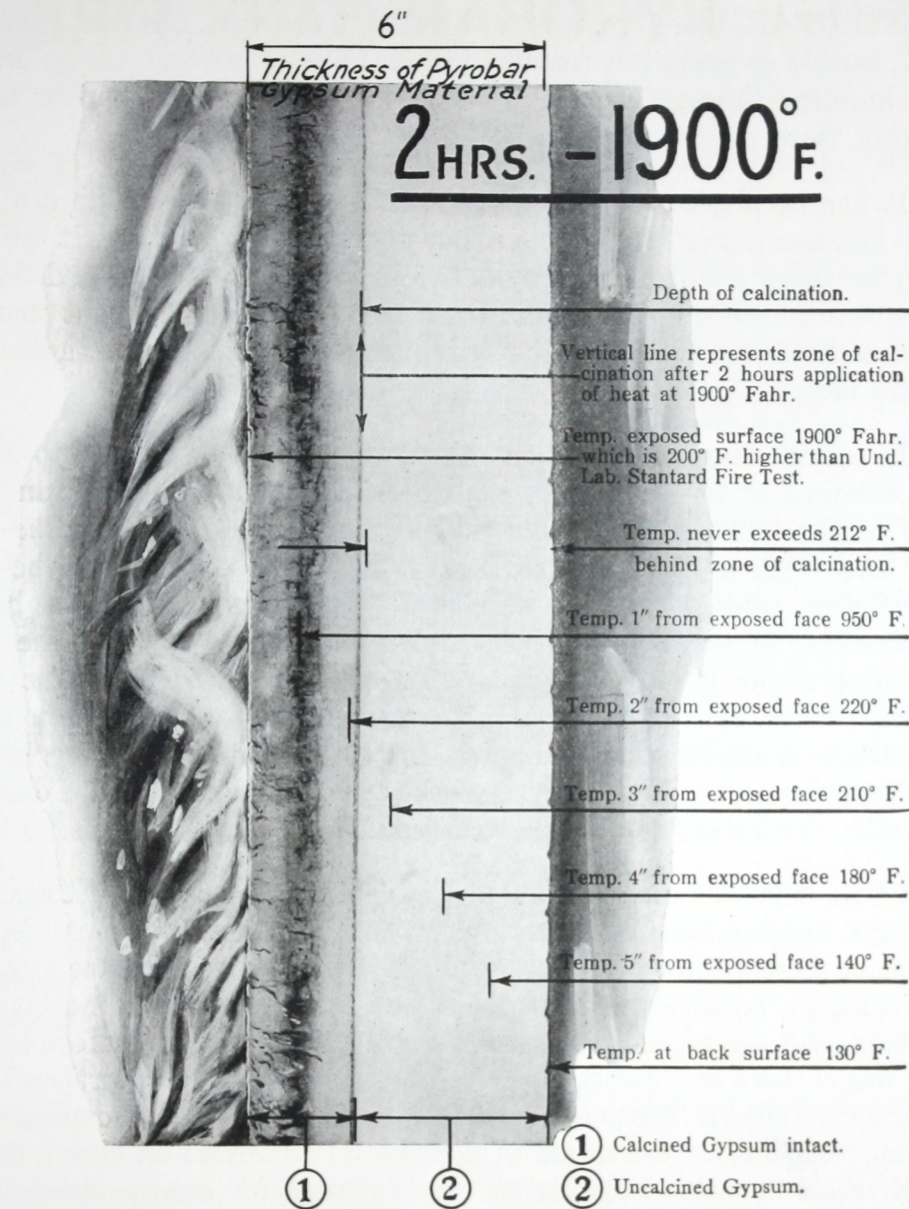
Pyrobar Does Not Appreciably Expand When Heated

There is practically no expansion in PYROBAR Gypsum Tile at temperatures below 212° F.—and, as we have seen, the temperature of PYROBAR Gypsum Tile back of the line of calcination *can never exceed 212° F. irrespective of the fire temperature.* This explains why there is practically no expansion in PYROBAR Tile, even under the most severe conditions.

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The above cross-sectional diagram is based upon results of tests made by the Underwriters' Laboratories, Inc. Observe that at the end of two hours exposure to a constant temperature of 1900 degrees F. (200 degrees in excess of the requirements of the Underwriters' Laboratories) the opposite side of the gypsum wall showed a temperature of only 130 degrees F., an increase of only 60 degrees above the normal temperature of the room, or but 3 1/6 % of the temperature at the exposed side.

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PYROBAR, therefore, when subjected to fire heat, does not collapse, crack, buckle or spall, but remains intact, thereby preventing the flames from bursting through the partition or, in the case of column or beam covering, from reaching the steel.

*Expansive
Materials
Poor Fire
Resistants*

It has been generally supposed that hollow clay products are fire-proof because manufactured by a burning process; however, it will be seen that these products, although obviously incombustible, are deficient in the two fireproofing essentials: their temperature throughout usually becomes the same as that of the fire, and their expansion increases with the fire heat.

In actual construction, when hollow clay products are used to cover steel columns or for partition walls, the tile are not free to expand, as when in the kiln, *but are firmly confined in place between columns and walls and between floors and ceilings.* The shells exposed to the fire expand more rapidly than the webs and opposite shells, the result being the wrecking of the exposed shells and cracking or spalling of the tile. Expansion frequently wrecks the tile by crushing and bulging the wall toward the fire, opening up large fissures in the construction. When the hose stream is applied, sudden contraction occurs and the clay tile, which are already seriously injured by the heat action, crack, spall and disrupt generally, permitting the flames to break through.

*Pyrobar
Resists Water*

PYROBAR Gypsum Tile laid in gypsum mortar bond firmly together, making a homogeneous construction, which, after having been subjected to a high temperature, will resist the eroding effect of the hose stream. The calcined portion merely washes away without the formation of openings, and the rapid cooling by water has no disrupting effect whatever; nor is there any displacement of the individual tile. Furthermore, because PYROBAR Tile does not disrupt or disintegrate after exposure to extreme temperature, the salvage value of a PYROBAR wall after a fire is far in excess of that of any other material used for steel protection or partitions, it being only necessary to replaster the side exposed to the flames.

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PYROBAR GYPSUM TILE FOR GIRDER, BEAM AND COLUMN COVERING

Quoting from the Building Code recommended by the National Board of Fire Underwriters', 1915:

*Why Steel
Requires
Insulation*

"It is well known that steel begins to lose its strength at about 500 Degrees Fahrenheit, and at 1000 Degrees F. approximately 50 to 70 per cent of its strength is gone. Such temperatures are produced in an ordinary fire, and if maintained even for a short time, are almost sure to produce collapse of exposed steel structural members."

The prime object of "fireproofing" structural steel is not so much to prevent the destruction of the steel by fire as to prevent its loss of strength when subjected to high temperatures. Obviously, even though a material practically invulnerable to fire is used for fireproofing, it does not follow that any protection is given to the steel unless that material also *insulates the metal* so that its temperature will not be raised above 500 Degrees F., the heat at which steel begins to lose its strength. PYROBAR is the ideal material for steel protection, for, as has already been shown, its temperature cannot be raised above 212 Degrees F.

In 1903 tests were made by the Bureau of Buildings, New York City, to determine the most suitable materials for the protection of steel columns from the action of fire. The conditions of these tests were that, after exposure to a continuous fire of 1700 Degrees F. for *two hours*, the steel columns should not attain a temperature of over 500 Degrees F.

*The
New York
City Test*

Gypsum protected columns, with the gypsum protective covering but 2 inches thick, at the end of this test showed an increase in the temperature of the steel column of only 151 Degrees F. This was a much lower temperature rise than for any other material tested.

*Gypsum
Proved
Superior*

It will be readily apparent, therefore, that when protected with PYROBAR, steel or cast iron columns or other structural members will not be heated to a degree of instability.

Assume that three steel columns, each 10 feet long, are protected by clay tile, concrete and PYROBAR Tile, respectively, and that the normal

*Expansion
of Three
Materials
Compared*

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temperature of 70 degrees is increased to 1700 degrees by fire. The resultant increase in the length of the protecting material would be:

Pyrobar	0.156 in.
Clay Tile	0.590 in.
Concrete	1.180 in.

From this it will be seen that the expansion of clay tile is four times as great, and that of concrete seven and one-half times as great as the expansion of PYROBAR. This slight expansion of PYROBAR is not sufficient to cause injury to the material.

FACTS ALL SHOULD KNOW ABOUT FIREPROOFING

Definition of "Fireproof"

"It is recognized that the term 'Fireproof' is misleading and should be abandoned for the more correct term 'fire-resistive'; but until the latter term has been authoritatively defined in a manner expressive of its elastic interpretations, it seems advisable to continue the use of the more common though objectionable word."

—BUILDING CODE—
NATIONAL BOARD OF FIRE
UNDERWRITERS, 1915.

No material is proof against destruction caused by intense heat of prolonged duration. The eventual failure may be due to cracking or spalling which is an infirmity of clay tile, or the disintegration of concrete or the gradual calcination of gypsum. Therefore, since it is impossible to entirely neutralize the destructiveness of high temperature, the problem is to minimize its effect—and PYROBAR Gypsum Tile, because of its property of calcination, most successfully accomplishes this object.

From a practical standpoint, PYROBAR is fireproof. The only effect of fire upon it is gradual calcination and this could never cause the failure of PYROBAR in a building fire, because the calcination progresses so slowly that long before PYROBAR would be totally calcined, all combustible material in the building would have been consumed and all expansive materials wrecked. PYROBAR is the *strong point* in any building.

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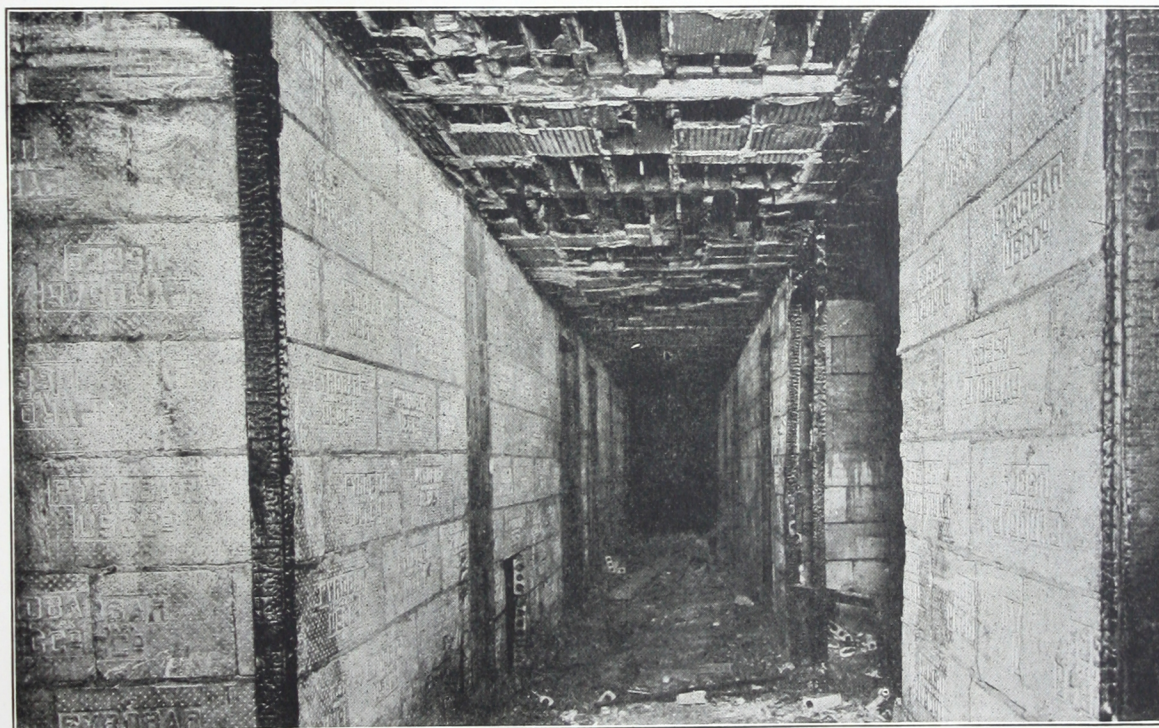
The claims of PYROBAR Gypsum Tile as a fireproof building material are based upon the actual results of tests made by the Underwriters' Laboratories, Inc.

*The Under-
writers'
Laboratory
Tests*

The standard test adopted by them is the ability of a material to withstand a temperature of 1700 Degrees F. for a period of two hours. This is based on the fact that furniture, trim and other combustibles in the room, when ignited, will maintain a temperature not to exceed 1700 Degrees for that period of time.

Gypsum Tile not only passed this test, but successfully resisted a temperature of 2200 Degrees F. for four hours—two hours longer and 500 Degrees in excess of the Underwriters' requirements. It is significant to note that Gypsum Tile is the only building material used for fireproof construction that has passed the Underwriters' rigid tests and secured the approval of the National Board of Fire Underwriters.

In studying the official test panels pictured on pages 19, 20 and 21, the *abnormal temperatures and time periods* to which most of these specimens were subjected should be borne in mind.

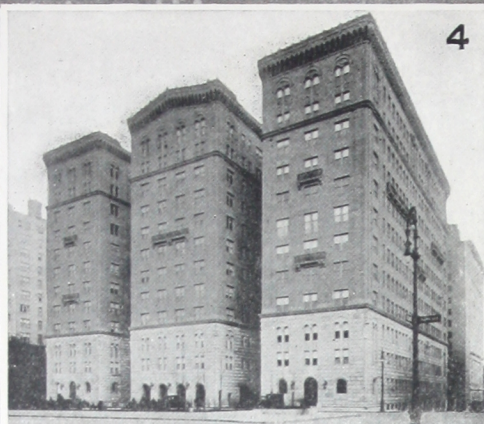


The above picture shows how PYROBAR withstands an actual building fire. It is a corridor in the Statler Hotel, Cleveland, after a fire which broke out while the building was under construction and before the walls were plastered. Note the perfect condition of PYROBAR. Under ordinary fire conditions, PYROBAR possesses a large factor of safety.

UNITED STATES



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4



5



6



7



8



1



9



10



19



- 4—Montana Apt. Bldg., New York City, Rouse & Goldstone, N. Y. City, Archts.
 5—State Normal School, Milwaukee, Van Ryn & DeGelleke, Milwaukee, Archts.
 6—Y. M. C. A. Bldg., Brockton, Mass., Shattuck & Hussey, Chicago, Archts.
 7—Woodward Apts., Washington, D. C., Harding & Upman, Wash., D. C. Archts.
 8—A. A. Busch Residence, St. Louis, Widmann & Walsh, St. Louis, Archts.
 9—Albany Hotel Annex, Denver, J. B. Benedict, Denver, Archt.

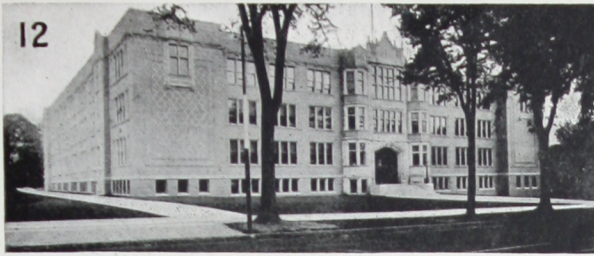
- 10—New Ridge Arcade, Kansas City, Smith, Rea & Lovitt, Kansas City, Archts.
 11—Hotel Fontenelle, Omaha.
 12—Commercial High School, Springfield, Mass., Kirkham & Parlett, Springfield, Archts.
 13—Delaware County Court House, Media, Pa., Clarence W. Brazer, New York City, Archt.

Statler Hotels, G. B. Post & Sons, New York City, Archts.
 2—Detroit

1—Buffalo



11



12



14



13



15



16



2



3



17

Sons, New York City, Architects.
Detroit

3—Cleveland



20



18



21

- 14—Cook County, Illinois, Detention Hospital, Chicago, R. E. Schmidt, Chicago, Archt.
- 15—Phipps' Model Tenements, New York City, Grosvenor Atterbury, New York City, Archt.
- 16—481 West End Ave., New York City, Schwartz & Gross, New York City, Archts.
- 17—1st National Bank Bldg., Milwaukee, D. H. Burnham & Co., Chicago, Archts.

- 18—Tower Building, Chicago, H. B. Wheelock, Chicago, Archt.
- 19—H. S. Kennedy Residence, Troy, N. Y., Demers & Mosley, Troy, Archts.
- 20—C. B. Ames Residence, Oklahoma City, Okla., Layton & Smith, Oklahoma City, Archts.
- 21—Tuberculosis Sanitarium, Cooley Farms, Warrensville, Ohio, J. Milton Dyer, Cleveland, Archt.

*Facsimile
of Under-
writers'
Laboratories
Approval of
Pyrobar*

LIST OF Inspected Mechanical Appliances July, 1916 Underwriters' Laboratories

Principal Office and Testing Station
207 East Ohio Street, Chicago
Branch Offices Throughout
United States and Canada.
London, England

Gypsum Blocks

Underwriters' Laboratories' Standard for Gypsum Blocks includes the following nominal or trade sizes: 2-inch solid, 2½, 3, 4, 5, 6, and 8-inch. Sizes from 2½ to 5-inch have single rows of core holes. The 6 and 8-inch sizes have two rows of core holes. Core holes are of circular, elliptical or rectangular cross-section.

Partitions built of these blocks shall have the blocks set on non-combustible foundations and laid with staggered joints in properly tempered gypsum plaster containing not to exceed three parts of sand, and shall be coated on each side with the same material, fibered with hair or wood, at least ¼-inch in thickness and are standard for use as non-bearing corridor and room partitions in office buildings, hotels, apartments and buildings of like class of fire-resisting construction, and acceptable for use at enclosures to vertical communications in such buildings where standard enclosures * are not required, and when the partition heights do not exceed the following:

Nominal or Trade Size of Block	Maximum Height of Non-Bearing Partition
2 inch, solid	10 feet
2½ inch, cored	10 feet
3 inch, cored	13 feet
4 inch, cored	17 feet
5 inch, cored	20 feet
6 inch, cored	30 feet
8 inch, cored	40 feet

Where standard protection is required at openings in corridor and room partitions, standard corridor and room partition fire doors and door frames at door openings, and standard fire window frames with standard wire glass at transoms and corridor lights should be used.

Inspection departments having jurisdiction should be consulted in all cases before installations are made.

INSPECTION SERVICE: The purpose of field inspection is to make frequent inspections and examinations of products marketed, and to supervise the listed product shipped. Inspectors appointed by Underwriters' Laboratories visit buildings, warehouses, factories, or other places where the product is available for examination, for the purpose of making inspection of the product.

United States Gypsum Co., Chicago, Ill. Factories at Oakfield, N. Y.; Gypsum O.; Fort Dodge, Ia.; Plasterco, Va.; Southard, Okla.; Rapid City, S. D.

Pyrobar gypsum blocks, circular cored patterns in all standard sizes. Trade mark: Pyrobar. U. S. G. Co.

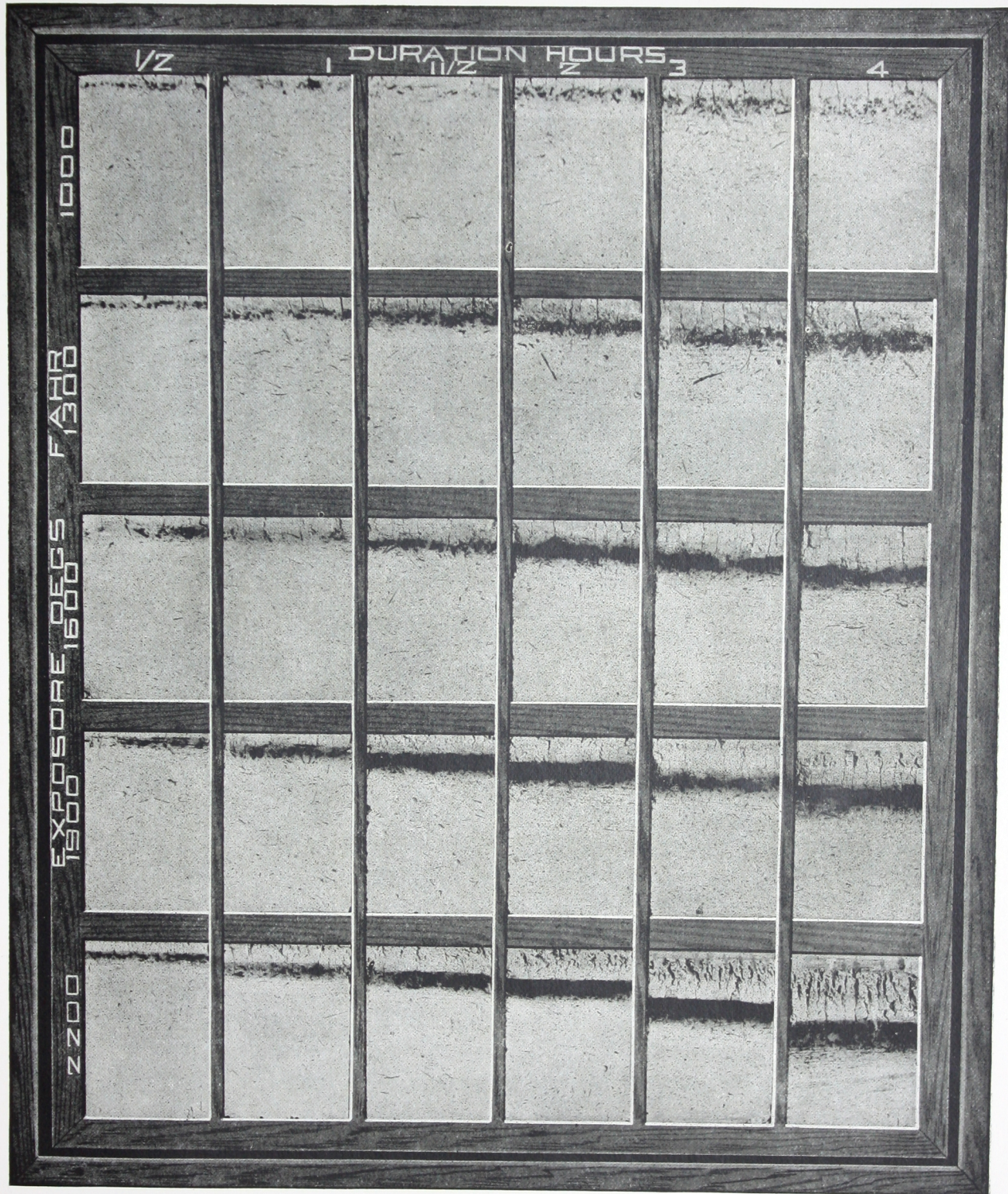
*Note: At the time of the above approval, no material or construction whatever had received the Underwriters' endorsement for "standard enclosures." Since that time (on January 31 and February 1, 1918) a gypsum enclosure construction has been tested at the Underwriters' Laboratories and has received their approval for "standard enclosures" in fireproof buildings of the highest type. Full information regarding this elevator enclosure construction and test data will be furnished upon request.

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THE UNDERWRITERS' TESTS



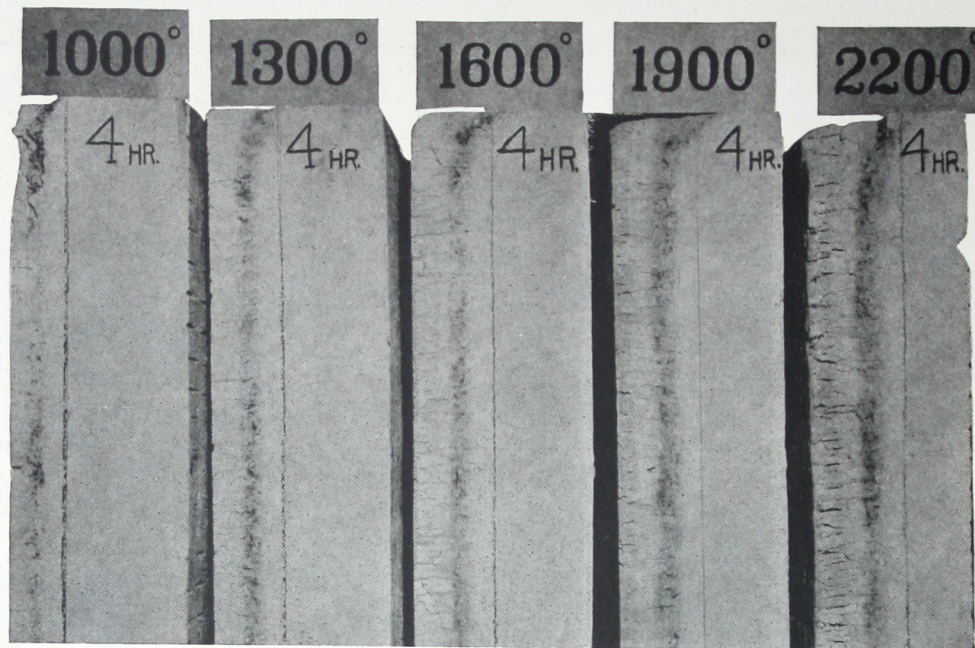
Above is a photographic reproduction of cross sections through 6 inch gypsum walls which underwent the Underwriters' Laboratories' tests and which show the effects of various temperatures from 1000° to 2200° F. for periods of 1/2 hour to 4 hours. Do not lose sight of the fact that the maximum requirements are *but 1700° for 2 hours*.

UNITED STATES

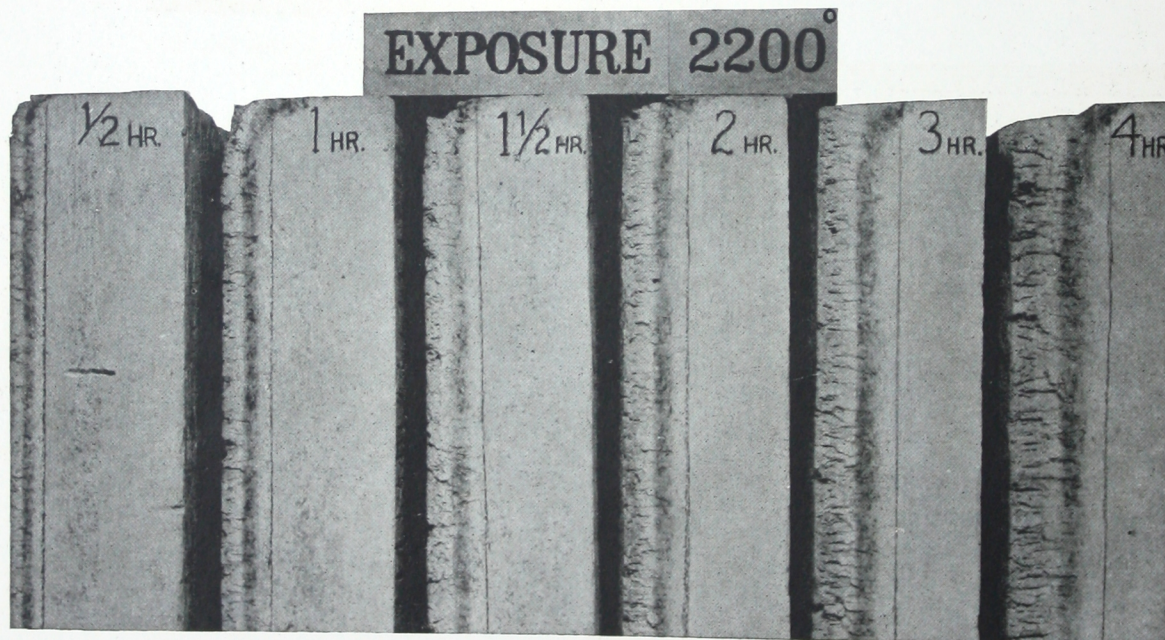


GYPSUM COMPANY

THE UNDERWRITERS' TESTS



Cross Section of 6" Gypsum Tile exposed for 4 hours to temperatures of 1,000 to 2,200 Deg. F.
Note that all panels were exposed for *double the required length of time*.



Cross Section of 6" Gypsum Tile exposed to 2,200 Deg. F. (23% above Underwriters' standard) for periods of $\frac{1}{2}$ to 4 hours (double time required).

Examination of these cross sections of Gypsum Tile discloses the important truth that the *depth of calcination is not in proportion to the intensity or duration of the heat applied*. The longer the fire is applied, the more slowly the calcination proceeds.

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THE UNDERWRITERS' TESTS

Showing face of Gypsum Tile after being subjected to a temperature of 2200 Degrees Fahrenheit for periods of one-half and four hours. Of special interest is the fact that there are no through fissures or spalling of the Tile, but instead, the calcined portion holds



Surface After Exposure to 2200 Deg. F. for Period of $\frac{1}{2}$ Hour.



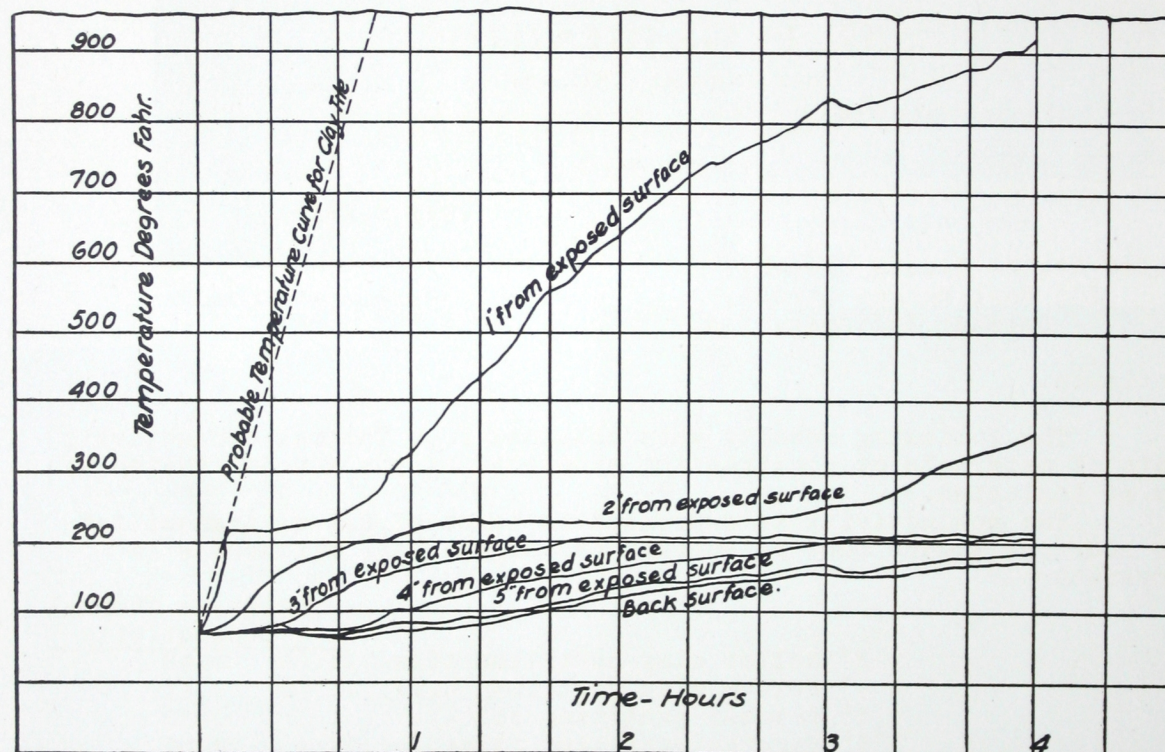
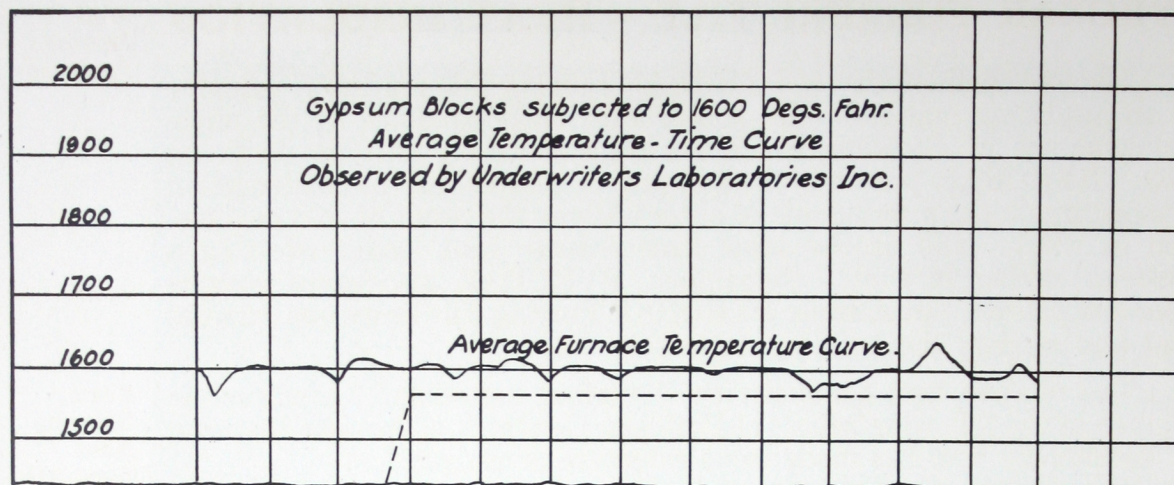
Surface After Exposure to 2200 Deg. F. for Period of 4 Hours.

together in a compact, steamy mass, offering a barrier to the transmission of heat to the gypsum back of the line of calcination. These pictures and those on opposite page are reproduced from report of Underwriters' Laboratories, Inc.

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Heat
Conduction
Chart

This chart, reprinted from the Underwriters' Laboratories' report, graphically illustrates the rise in temperature of gypsum for any period of time up to four hours. This increase is rapid from the room temperature of 70 Degrees F. to the temperature of calcination, 212 Degrees F., after which the temperature increase is very slow as shown by the pronounced drop in the rise of the curve. *Uncalcined gypsum will not maintain a temperature above the temperature of boiling water.*

UNITED STATES



GYPSUM COMPANY

PYROBAR FURRING TILE — HEAT INSULATION

Wall
Furring
Features

The low conductivity of PYROBAR Furring Tile renders it valuable as an insulating material. Its non-conduction is explained by the physical structure of Gypsum, which is a mass of closely knit, air confining cells. PYROBAR prevents the staining of plaster due to condensation of moisture on the interior side of outer walls as the result of cold penetration in winter, and at the same time reduces heat losses, effecting a material saving in fuel. Remember, PYROBAR also saves *erection labor and plaster*. In summer PYROBAR Furring Tile keeps out external heat and renders the building noticeably cooler.

The relative heat conductivity of various materials of construction is given in the following report of Professor Gebhardt of Armour Institute of Technology who has made some extensive investigations:

Tests
Showing
Non-
Conductivity

G. F. GEBHARDT

MECHANICAL ENGINEER

INSPECTION, TESTS AND
CONSULTATION

OFFICE AND LABORATORIES
ARMOUR INSTITUTE OF TECHNOLOGY

CHICAGO

PHONE DOUGLAS 390

July 7, 1916.

United States Gypsum Company,
205 West Monroe Street,
Chicago, Illinois.

Gentlemen:

The following results were obtained from Thermal conductivity tests of materials of construction submitted by you and designated by you as indicated.

The conductivity is expressed in terms of B.t.u. transmitted per hour per square foot of surface per degree Fah. difference in temperature.

	Relative Thermal Conductivity
3" hollow clay partition tile....	0.46
4" hollow clay partition tile....	0.41
3" Pyrobar partition tile.....	0.33
4" Pyrobar partition tile.....	0.30

Respectfully submitted.

G. F. GEBHARDT.

Per

J. C. Peebles.

Testing Engineering
J. C. Peebles.

UNITED STATES



GYPSUM COMPANY

Relative
Sound
Resistance

LEWIS INSTITUTE TESTS ON SOUND CONDUCTION

Appreciating the importance of reducing the transmission of sound through partition walls in modern buildings, Professor Woodworth of Lewis Institute, Chicago, engaged in extensive laboratory tests to determine accurately which materials of construction afforded maximum resistance to sound conduction. His letter apprising us the result of his experiments follows:

LEWIS INSTITUTE

CHICAGO

OFFICE OF THE
DIRECTOR

May 19, 1914

United States Gypsum Company
205 West Monroe St., Chicago, Ill.

Gentlemen:

A series of tests have been made at the Lewis Institute, and the following report is respectfully submitted.

OBJECT.

The object of the test was to determine the relative ease with which sound is transmitted through walls made of different materials. This has particular reference to the overhearing of speech and noise in adjoining rooms separated by walls of known structure and material.

Results.

The numbers given in Table A. in column "Relative Resistance" indicate the relative difficulty with which sound is transmitted through each of the walls. That wall which has the highest value will be the best for preventing the transmission of sound.

Table A.

Relative resistance of Walls to Sound Transmission.

Material	Structure	Rel. Resist.
4" Clay Tile	Laid in Cement Mortar	5500
3" " "	" " " "	5400
2" " "	" " " "	5250
2" Solid Pyrobar tile	" " Sanded Gyp. cement	8375
3" Hollow "	" " " " " "	9125
4" " "	" " " " " "	8825

These results show that 60% more sound is conducted through plastered clay tile walls than through plastered PYROBAR GYPSUM TILE walls of same thickness installed as illustrated and described,

Respectfully submitted,

Philip B Woodworth
Prof of Engineering & Dean

UNITED STATES



GYPSUM COMPANY

PYROBAR GYPSUM TILE

Size- Weight -Type

PYROBAR Gypsum Tile for partitions and furring are made in standard face dimensions: 12" x 30", in both solid and hollow types, and of various thicknesses to meet underwriters' standards, architects' specifications and the building laws of the various cities. A table of sizes and weights is shown at the bottom of this page.

The thickness of the partition is determined primarily by the ceiling height and by its location in the building. As a rule, 3 or 4 inch Tile are the sizes used for the average building where partitions do not exceed 15 feet in height. Corridor partitions are generally thicker than cross partitions.

Two-inch Solid PYROBAR Tile are used for partitions not exceeding 10 feet in height, for covering columns and for constructing pipe chases, vent ducts, dumb-waiter shafts, etc.

Split and Hollow PYROBAR Furring are laid up against exterior walls and securely spiked every square yard. Joints should be broken the same as for partition work. Furring may also be fastened to the building wall by means of wall ties. The hollow portion of the tile should be placed against the wall, thus minimizing the contact area with the outside walls.

Where furring stands free from the wall, allowing space for pipes, vents, etc., it is customary to use 2-inch solid, 3-inch hollow or 4-inch hollow PYROBAR Tile, for the reason that more rigidity is required. Free standing furring is anchored to the exterior wall either by running dwarf walls between the furring and exterior wall, or by imbedding corrugated metal wall ties in the exterior wall of sufficient length so that they can be imbedded in the joints between the tile.

*How to Use
the Various
Types of
Partition
and Furring
Tile*

STANDARD PYROBAR GYPSUM PARTITION TILE

Size of PYROBAR Gypsum Tile	For Ceiling Heights up to	Weight Tile, per sq. ft. Lbs.	Weight Mortar, per sq. ft. Lbs.	Weight Plaster, One Side, per sq. ft. Lbs.	Total Weight Plastered One Side, per sq. ft. Lbs.	Weight Plaster, Two Sides, per sq. ft. Lbs.	Total Weight, Plastered Two Sides, per sq. ft. Lbs.
1½-in. Split—1½"x12"x30"	Furring	4.9	1	3	7.9	6	10.9
2-in. Split—2"x12"x30"	Furring	6.4	1	3	9.4	6	12.4
2-in. Solid—2"x12"x30"	10 feet	9.4	1	3	12.4	6	15.4
3-in. Hollow—3"x12"x30"	13 feet	9.9	1.2	3	12.1	6	15.9
3-in. Solid—3"x12"x30"	15 feet	13.0	1.2	3	16.0	6	19.0
4-in. Hollow—4"x12"x30"	17 feet	13.0	1.63	3	16.0	6	19.0
5-in. Hollow—5"x12"x30"	25 feet	15.6	2.04	3	18.6	6	21.6
6-in. Hollow—6"x12"x30"	30 feet	16.6	2.45	3	19.6	6	22.6
8-in. Hollow—8"x12"x30"	40 feet	22.4	3.26	3	25.4	6	28.4

COMPARATIVE WEIGHTS OF PYROBAR AND CLAY TILE

Thicknesses	PYROBAR Weight per sq. ft.	CLAY TILE Weight per sq. ft.	3" TILE IN PLACE	HOLLOW PYROBAR	HOLLOW CLAY TILE
2" Hollow	6.4 lbs.	12 lbs.	Unfinished 3" per sq. ft.	9.9 lbs.	14 lbs.
3" Hollow	9.9 lbs.	14 lbs.	Mortar for setting	2 lbs.	4 lbs.
4" Hollow	13 lbs.	16 lbs.	Plaster, both sides	6 lbs.	9 lbs.
5" Hollow	15.6 lbs.	19 lbs.			
6" Hollow	16.6 lbs.	24 lbs.	Total weight, per sq. ft.	17.9 lbs.	27 lbs.

UNITED STATES



GYPSUM COMPANY

PYROBAR BEAM AND COLUMN COVERING

*Unequaled
Fire
Protection*

At no point in the building is maximum fire protection of such vital importance as around structural steel members, for should these members fail, the whole building would collapse. As stated on page 13, PYROBAR offers the best possible protection to steel columns, beams and girders. This is because PYROBAR does not permit sufficient heat to reach the steel to cause failure, and because even when subjected to fire and water, it does not expand, contract and spall, leaving the steel unprotected.

*Perfect
Alignment*

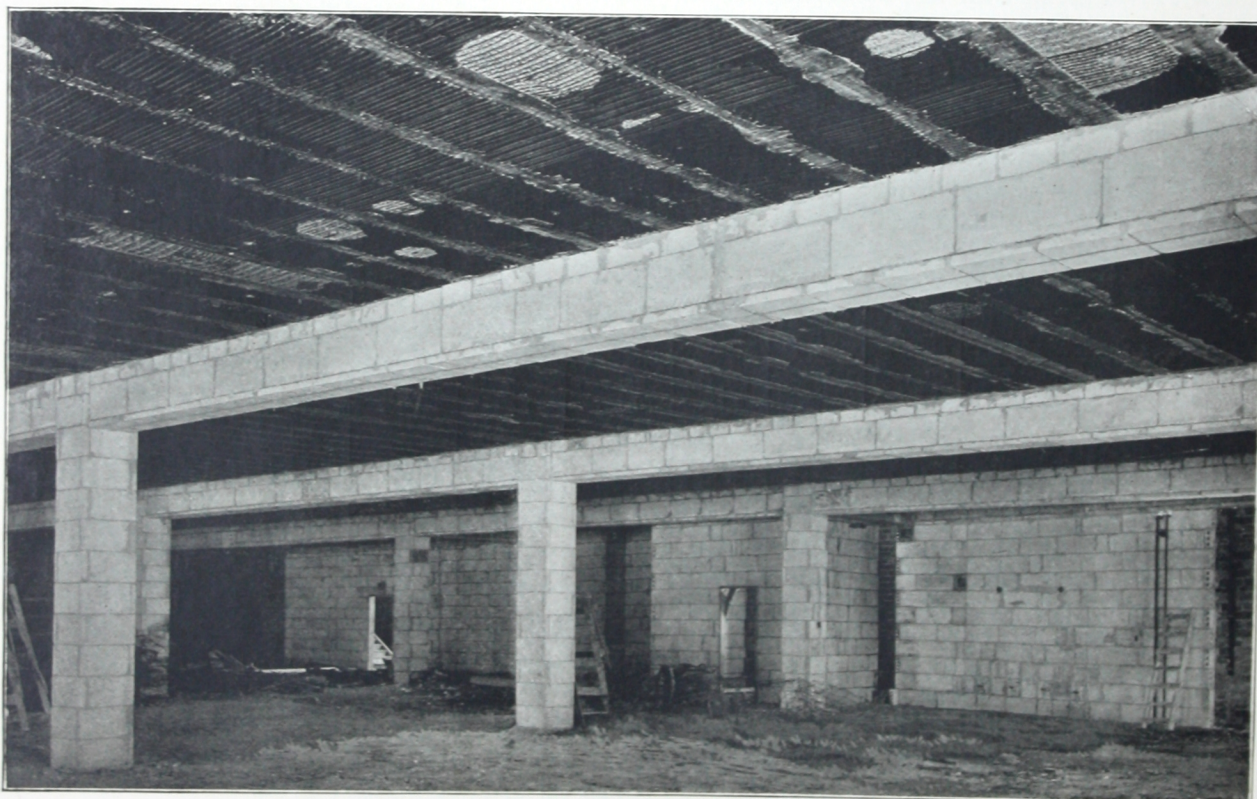
PYROBAR Gypsum Beam, Column and Girder Covering, because of its light weight can be applied in much quicker time than any other fire-resistive covering.

The PYROBAR units, being cast in steel moulds, are necessarily uniform, and the covering, when in place, insures a straight plastering job, and also means a considerable saving in plastering material.

*Construction
Details*

As shown in the details on next page, PYROBAR beam covering is a combination of special gypsum Shoe Tile soffits and standard hollow PYROBAR Partition Tile.

Columns are usually covered with standard hollow or solid PYROBAR Partition Tile. Special sized tile can be made to suit requirements.



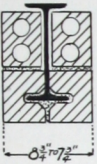
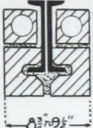
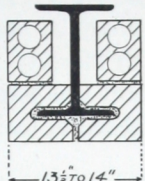
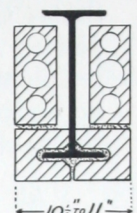
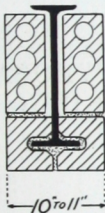
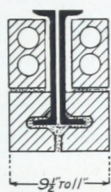
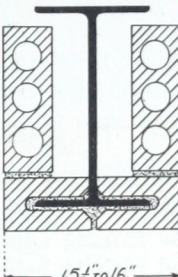
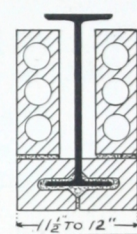
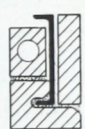
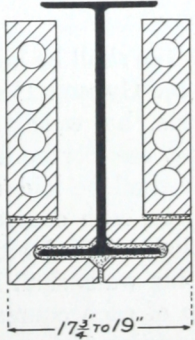
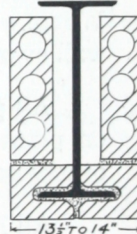
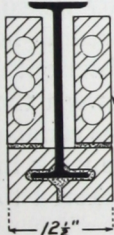
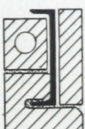
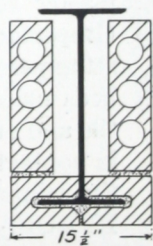
View showing Beam and Column Covering, Sweeney Houston Building, Detroit, Michigan. Smith, Hinchman & Grylls, Architects. Note that all columns are square and beams in alignment due to uniformity of tile.

UNITED STATES



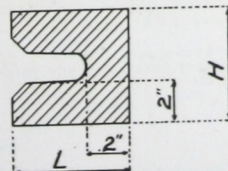
GYPSUM COMPANY

PYROBAR BEAM COVERING DETAILS

STANDARD AND SUPPLEMENTARY BEAMS	STANDARD CHANNELS	BETHLEHEM GIRDER BEAMS	BETHLEHEM I BEAMS
TYPE "A" SHOE  <div> SIZE OF BEAM 5"-9$\frac{3}{8}$" 6"-12$\frac{1}{2}$" 7"-15" 8"-17$\frac{1}{2}$" 8"-18" 9"-21" 10"-22" 10"-25" 10"-30" </div>	TYPE "A" SHOE  <div> SIZE OF CHANNEL 2"-5"-6$\frac{1}{2}$" 2"-6"-8" 2"-7"-9$\frac{3}{8}$" 2"-8"-11$\frac{1}{4}$" 2"-9"-13$\frac{1}{2}$" </div>	TYPE "D" SHOE  <div> SIZE OF BEAM 8"-32L" 9"-38" 10"-44" 12"-55" 12"-70" </div>	TYPE "B" SHOE  <div> SIZE OF BEAM 8"-17$\frac{1}{2}$" 8"-19$\frac{1}{2}$" 9"-20" 9"-24" 10"-23$\frac{1}{2}$" 10"-28$\frac{1}{2}$" 12"-28$\frac{1}{2}$" 12"-32" 12"-36" 13"-38" 15"-41" 15"-46" </div>
TYPE "B" SHOE  <div> SIZE OF BEAM 12"-27$\frac{1}{2}$" 12"-31$\frac{1}{2}$" 12"-35" 12"-40" 15"-36" 15"-42" 15"-60" 18"-46" 18"-55" 18"-75" 20"-65" 20"-80" 21"-57$\frac{1}{2}$" 24"-69$\frac{1}{2}$" 24"-80" </div>	TYPE "B" SHOE  <div> SIZE OF CHANNEL 2"-10"-15" 2"-12"-20$\frac{1}{2}$" 2"-15"-33" </div>	TYPE "E" SHOE  <div> SIZE OF BEAM 15"-73" 15"-104" 15"-140" 18"-92" 20"-112" 24"-120" 26"-150" </div>	TYPE "C" SHOE  <div> SIZE OF BEAM 15"-54" 15"-64" 15"-71" 18"-46$\frac{1}{2}$" 18"-52" 18"-54" 18"-59" </div>
	TYPE "D" SHOE  <div> SIZE OF CHANNEL 5"-6$\frac{1}{2}$" 6"-8" 7"-9$\frac{3}{8}$" 8"-11$\frac{1}{4}$" 9"-13$\frac{1}{2}$" </div>	TYPE "F" SHOE  <div> SIZE OF BEAM 20"-140" 24"-140" 26"-160" 28"-165" 28"-180" 30"-180" 30"-200" </div>	TYPE "D" SHOE  <div> SIZE OF BEAM 20"-59" 20"-64" 20"-69" 20"-72" 20"-82" 24"-75" 24"-83" 26"-90" 28"-105" </div>
TYPE "C" SHOE  <div> SIZE OF BEAM 24"-105" </div> <p>NOTE-All Cover Tile To Be Hollow Pyrobar</p>	TYPE "E" SHOE  <div> SIZE OF CHANNEL 10"-15" 12"-20$\frac{1}{2}$" 15"-33" </div>		TYPE "E" SHOE  <div> SIZE OF BEAM 30"-120" </div> <p>NOTE-All Cover Tile To Be Hollow Pyrobar</p>

SHOE TILE STANDARDS

ALL SHOES 18" LONG



TYPE	L	H	WGT. LBS. PER LIN. FT.
A	3 $\frac{3}{8}$ "	4 $\frac{3}{4}$ "	7 $\frac{1}{2}$
B	5"	5 $\frac{1}{4}$ "	9 $\frac{1}{2}$
C	5 $\frac{1}{2}$ "	5 $\frac{1}{2}$ "	11
D	6 $\frac{1}{2}$ "	5 $\frac{1}{4}$ "	11 $\frac{3}{4}$
E	7 $\frac{1}{2}$ "	5 $\frac{3}{4}$ "	13 $\frac{1}{2}$
F	8 $\frac{1}{2}$ "	5 $\frac{3}{4}$ "	16 $\frac{1}{2}$

SPECIFICATIONS FOR PYROBAR GYPSUM TILE

Partitions Unless otherwise specified or shown, all partitions shall be built of United States Gypsum Company's PYROBAR Gypsum Tile, of thickness indicated on plans. All partitions shall be started on the fireproof floor, and the tile shall be set plumb, leaving both faces of partitions straight and true. All partitions shall be wedged at ceiling and the joints slushed with mortar. The corners of all partitions shall be built log-cabin fashion, the tile alternating back and forth.

Column Covering All exposed interior columns shall be covered with PYROBAR Gypsum Tile, of thickness indicated on plans. These tile shall be laid in log-cabin fashion and the vertical joints shall be broken.

Girder and Truss Covering All girders, beams and trusses not specified to be covered with brick or concrete shall be covered with PYROBAR Beam Covering Gypsum Tile.

The protection of the webs and bottom flanges of girders, and of all members of trusses required by ordinances to be fireproofed, shall have a covering of gypsum not less than 2 inches thick.

Furring All outside walls, where shown on plans, shall be furred with PYROBAR Gypsum Tile of thickness and type indicated on plans, laid up against the wall. Where solid or hollow furring tile are used, these shall be securely spiked to the wall every square yard with 10d steel cut nails.

Shafts, Openings and Ducts All pipe chases, dumbwaiter shafts, heating and vent ducts, etc., where shown on plans, shall be constructed with 2-inch solid PYROBAR Gypsum Tile unless otherwise specified.

Mortar and Laying All PYROBAR Tile shall be laid up in mortar composed of any brand of U. S. G. Company's Unfibred Gypsum Cement Plaster (retarded for 4 hr. set)—*one part plaster to three parts, by weight, of clean, sharp, dry sand, thoroughly mixed. (Important: Do not use Portland cement or lime mortar). No mortar shall be retempered. All tile shall be laid with full, flush joints to a line, with horizontal beds uniformly level on each course. All joints, chinks and crevices between the tile and other work shall be filled with mortar well slushed in. All partitions coming in contact with existing walls shall be anchored by driving spikes into the walls in the joints at the top of each course. The wood door bucks shall be anchored to PYROBAR Tile by driving 10d cut nails into every course of tile.

Lintels Unless otherwise specified or shown, the PYROBAR Gypsum Tile over all openings shall be erected by laying in the form of jack arches. Skew backs shall be cut in all tile over jambs; intermediate tile shall be beveled and a key tile set in the center.

* MORTAR QUANTITIES: Approximately 8 sacks of gypsum plaster (neat) and one yard of sand, or 20 sacks of sanded plaster, are required to set 1,000 square feet of 3 or 4 inch tile.

UNITED STATES

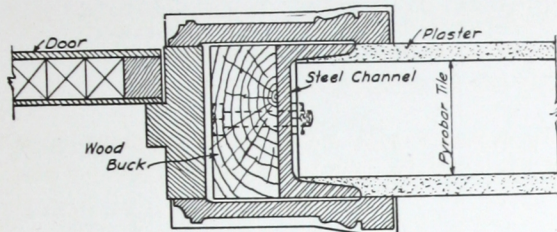


GYPSUM COMPANY

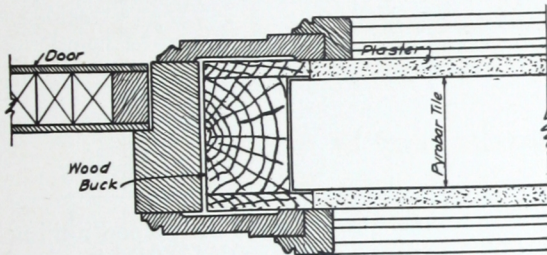
The Carpenter Contractor shall set and secure the rough bucks for openings ahead of the Contractor for this work so as to cause no delay. These bucks shall be left plumb and true by the Carpenter and shall be made of 2-inch lumber of the same width as the thickness of the partitions; and there shall be $\frac{1}{2}$ -inch by $2\frac{3}{4}$ -inch grounds nailed to the bucks, forming a rabbet to receive the PYROBAR Gypsum Tile.

Chair rail, picture mould and plastering grounds shall be nailed directly to PYROBAR by reverse, staggered nailing.

Wood
Frames

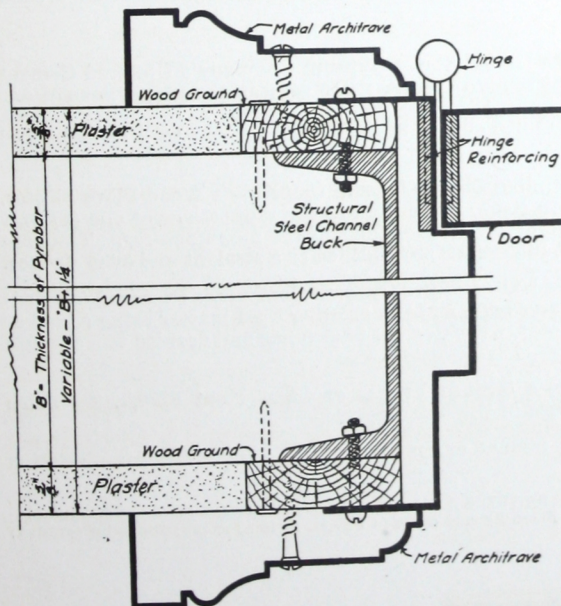


Section of Door Jamb showing Wood Buck Reinforced with Steel Channel

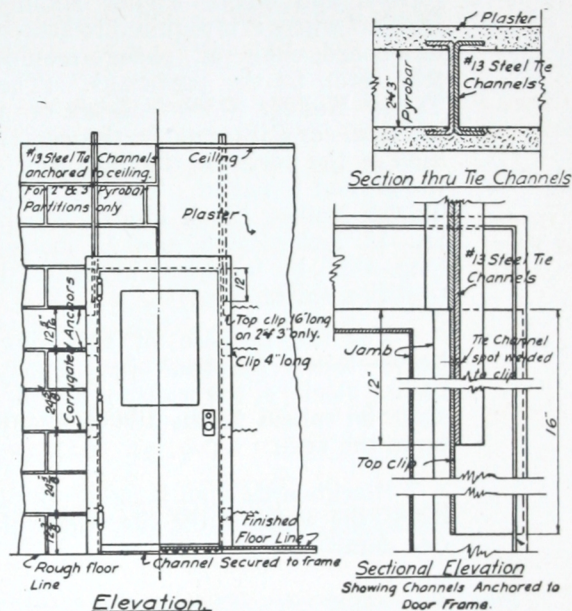


Section of Door Jamb showing Wood Buck
Note: This Buck may be either Plain or Rabbetted

Construction Details for Steel Door Frames
Structural Channel Buck



Construction Details for Steel Door Frames



Construction Details for Steel Door Frames

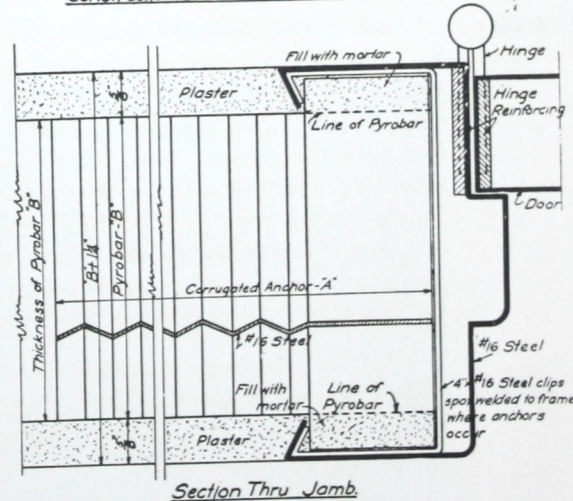


Table of Anchor Sizes for Various Size Walls
B Thicknesses of Pyrobar Tile — 2' 3' 4' 5' 6'
A Lengths of Corrugated Anchors — 6' 7' 6' 5'

UNITED STATES



GYPSUM COMPANY

Attaching
Trim,
Grounds,
Etc.

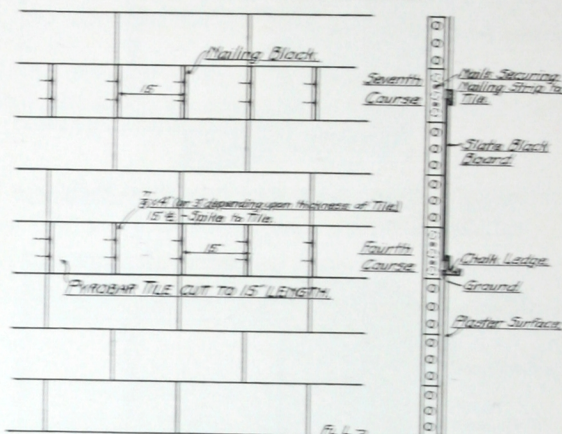
Baseboards shall be fastened by nailing a 1-inch by 12-inch wood nailing block of the width of the tile to one end of each PYROBAR Tile in base course before laying up tile, these nailing blocks to be furnished and nailed to tile by carpenter contractor, but to be set by this contractor.

Alternate A—The contractor will not be required to furnish or set nailing strips, as "Peds" manufactured by the United States Spot Ground Corporation, Omaha, Neb., shall be used for attaching trim, etc., according to manufacturer's specifications, the peds to be placed by other contractor.

Alternate B—This contractor shall furnish and erect "Taylor Nailing Blocks" where it is required to attach baseboard, chair rail, picture mould, trim, etc., to the partitions. (The Taylor Nailing Block consists of a wooden core inserted in the center void of the partition tile, into which the ground is nailed. The tile with Taylor Nailing Block inserts, which are 12 inches high and 15 inches long, shall be furnished in standard partition thicknesses.)

For the purpose of attaching heavy toilet fixtures, etc., 2-inch nailing blocks of the width of the tile shall be spiked to the tile and laid up in the wall.

METHOD OF INSERTING NAILING BLOCKS FOR FASTENING SLATE BLACKBOARDS AND HEAVY FIXTURES TO PYROBAR WALLS



Blackboards shall be securely fastened by attaching to a $\frac{1}{8}$ -inch wood nailing block, the width of the tile, which block shall be spiked to PYROBAR laid in place (see detail).

SPECIFICATIONS FOR PLASTERING PYROBAR GYPSUM TILE

Grounds All grounds shall be one-half inch.

Base Coat—For base coat, use any brand of the United States Gypsum Company's Unfibred Cement Plaster, which shall be mixed (not machine mixed) with clean, sharp sand in the proportions of one (1) part plaster to three (3) parts sand, by weight, according to the directions of the manufacturer. The base coat shall be applied in one coat, well filled out to grounds and darbied to a straight and even surface.

Alternate A—For base coat, use any brand of United States Gypsum Company's Wood Fibre Plaster, which shall be mixed (not machine mixed) with clean, sharp sand in the proportions of one (1) part plaster to one (1) part sand, by weight, according to the directions of the manufacturer. The base coat shall be applied in one coat, well filled out to grounds and darbied to a straight and even surface.

Alternate B—For base coat, use any brand of the United States Gypsum Company's Prepared (sanded) Unfibred Plaster, which shall be mixed with water only, no sand or other solid matter being added at the job. The base coat shall be applied in one coat, well filled out to grounds and darbied to a straight and even surface.

Finish *Finish*—Use United States Gypsum Company's (brand) Trowel or Sand Float Finish, the finish to be mixed and applied according to directions of the manufacturer.

Caution—Under no conditions shall Portland cement or lime mortar be used either for plastering or for laying up Gypsum Tile.

APPROXIMATE NUMBER OF 100-LB. SACKS REQUIRED TO PLASTER 100 YARDS (Average Conditions): Cement Plaster (sanded 3 to 1), 10 to 12 sacks; Wood Fibre Plaster (sanded 1 to 1), 14 to 16 sacks; Prepared (sanded) Plaster, 27 to 30 sacks.

UNITED STATES



GYPSUM COMPANY

SPECIFICATIONS FOR PYROBAR UNPLASTERED WAREHOUSE PARTITIONS

(APPROVED BY UNDERWRITERS' LABORATORIES, INC., 1918)

All partitions shown on drawings, except elevator shafts and stair walls, shall be built of PYROBAR Tile, minimum size to be 3 inch hollow.

These partition walls are not to be plastered. All Tile shall be sound, dense and full weight. No wet or broken tile shall be used.

Laying—All tile shall be laid with full flushed joints, with horizontal beds uniformly level on each course. All partitions shall be started on the fireproof floors, which shall be level. All partitions shall be wedged and filled in with mortar, flushed at both sides.

Intersections—All intersecting partition walls shall be bonded every third course, starting at the third course above the floor. Exposed core openings shall be filled with mortar.

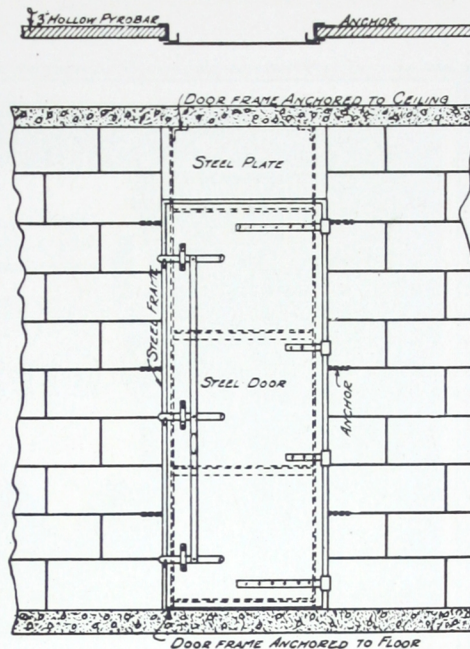
Corners—All corner partitions shall be bonded with joints alternating back and forth. Exposed core openings shall be filled with mortar.

At Brick Walls—All partitions joining existing brick walls shall be securely anchored to walls by means of 10d steel cut nails driven into the brick joint at each tile course.

Mortar—All Pyrobar Gypsum Tile shall be laid in mortar composed of one (1) part U. S. Gypsum Company's Unfibred Cement Plaster (retarded for 4 hr. set) and three (3) parts sand. (Do not use Portland cement or lime mortar.) Mortar which has set shall not be retempered and used.

Door Frames—The steel door frames shall extend from floor to ceiling and be of channel type to receive the tile. The frames shall be securely anchored to the floor and ceiling. The space between the door frame and ceiling shall be filled in with steel plate. Tile shall be fitted in the steel bucks and thoroughly slushed with Gypsum Mortar.

Anchorage—The partition walls shall be anchored to steel door frames by means of flat strap anchors, every third course, starting at the second course above the floor, these anchors to be a part of the door frames.

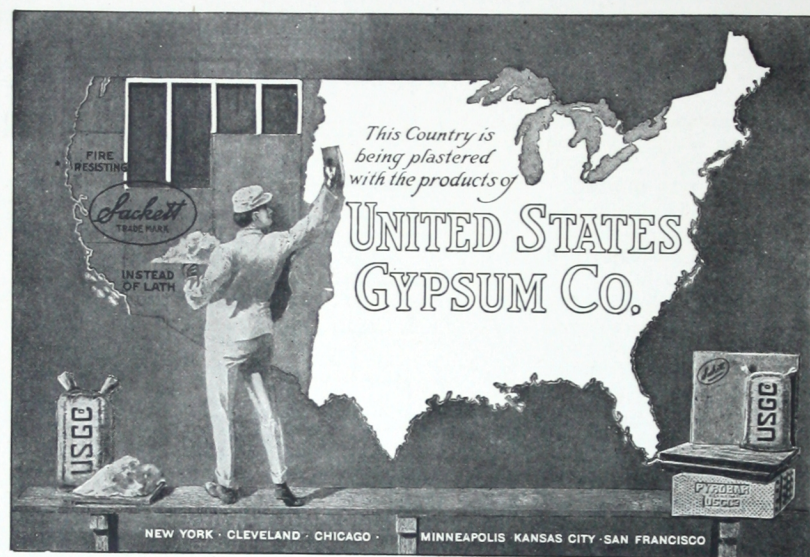


METHOD OF ATTACHING FIRE-PROOF PARTITIONS TO DOORS.

STORAGE WAREHOUSE PARTITIONS.



Erecting PYROBAR (unplastered) Warehouse Partitions.



PRODUCTS

PYROBAR Gypsum Tile.	U. S. G. Cement Plaster.
PYROBAR (Structolite) Roof Tile.	U. S. G. Wood Fibre Plaster.
PYROBAR (Structolite) Floor Filler Tile.	U. S. G. Prepared (sanded) Plaster.
Sackett and Adamant Plaster Board.	U. S. G. Bond Plaster (for plastering concrete surfaces).
Jester-Sackett Solid and Hollow Partitions.	U. S. G. No-Lime Trowel and Sand Float Finishes.
Jester-Sackett Suspended Ceilings.	U. S. G. Gauging Plasters.
Sackett Soffit Ceilings.	U. S. G. Moulding Plasters.
Sheetrock Wall Board.	Ivory Keene's Cement.
	Ivory Hydrated Lime from Ohio.

UNITED STATES GYPSUM COMPANY

WORLD'S LARGEST PRODUCERS OF GYPSUM PRODUCTS

CHICAGO, 205 W. Monroe Street

NEW YORK	BUFFALO	CLEVELAND	DETROIT
MINNEAPOLIS	KANSAS CITY	SAN FRANCISCO	



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